

A MALARIA SURVEY OF AJMER CITY

DATA BY

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This report is dedicated to the Municipal Committee of Ajmer. If at any time they should decide to interest themselves seriously in the prevention of the incidence of Malaria which is such a serious menace to the health of the citizens of Ajmer, it is hoped that it may be of considerable value to them.

PREFACE

This Survey was carried out during the period July 1st to December 31st 1930.

All work connected with it was of a voluntary nature.

With very few exceptions all statistics are based on the 10 years period from 1920 to 1929 inclusive.

The Senior Author was responsible for the General Direction of the Survey and for all Spleen measurements.

The Junior Author was responsible for the Identification of Species, Blood smear examinations, Statistical Graphs and Photographs.

The rest of the work was team work.

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Dyers' houses in Ghas Katla. Water tubs and earthen pots of drinking water always full of *A. stephensi* larvae.



Baori at Idgah. *A. stephensi* constantly found breeding here.



Baori close to Ajmer Club. *A. stephensi* constantly found breeding here in large numbers.



Nullah alongside City Electrical Power House. *A. rossii* and *A. stephensi* constantly found breeding here in enormous numbers throughout the whole year.

CHAPTER I.

BRIEF DESCRIPTION OF AJMER.

Ajmer City, the second city of Rajputana, is situated to the North of the British District of Ajmer-Merwara, on Lat : 25.20°, Long : 74.15°, and comprises an area of 14.4 square miles. The Aravalli range of hills which has its beginning at the Ridge in Delhi comes into sudden prominence near Ajmer and continues to Mount Abu in Sirohi State. Ajmer City lies on a plateau 1,500 feet above sea level and is completely surrounded by hills, the highest of which is Taragarh 2,865 feet above sea level. It is at the base of Taragarh and encroaching on its slopes that the densest part of the city area lies. The range of hills between Ajmer and Nasirabad forms the dividing watershed of India and this feature eliminates rivers from the immediate area. The rocks belong to the Archaean type consisting of Gneiss, Shists and Limestone, &c., mostly in the Quartzite form, and this formation gives rise to very little vegetation except in valleys where a mixture of yellow loam and sand makes cultivation possible.

Within the hills surrounding the city is a large tank, Ana Sagar, lying to the North-west, which only dries up after the failure of more than one monsoon. In a depression in the centre of the area is a small tank called Beechla which is only filled during the monsoon months.

The climate of Ajmer is variable with an annual average maximum temperature of 87.94° and minimum of 64.72°. January is the coldest month with an average temperature of 58.02° and May the hottest with an average temperature of 89.93°. The monsoon is variable, but the wet season usually begins early in July and continues to the middle or end of October. The amount of the annual rain fall shows considerable fluctuation, but for the time under review was 21.4" per annum.

The average monthly prevailing winds in Ajmer during 1920-1929 were as follows :—

Jan	Feb.	Mar.	Apl.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
N ⁰ W	N ² W	S ⁰³ W	W	S ⁷⁰ W	S ⁸⁴ W	S ⁸⁷ W	S ⁸⁵ W	S ⁸⁰ W	S ⁸² W	N ² W	N ²⁴ E	S ⁸⁷ W

The population of Ajmer as recorded in the Census of 1921 was 113,512 consisting of :—

Musalmans	..	..	..	53,470
Hindus	..	..	..	52,088
Christians	..	..	..	3,193
Jains	..	..	..	2,991
Animists	..	..	..	128
Others	..	..	..	1,042

As this Census was taken during the Khawaja Sahib Fair the actual normal figures would be slightly less.

The above mentioned Census gives the following details of occupation :—

A. Production of Raw Material & Exploitation of Animals and Vegetation.

Males	..	..	..	2,498
Females	..	..	..	581
Dependents	..	..	..	2,016
Total	..	..	..	4,994

B. Preparation & Supply of material substances.

Males	..	..	..	22,859
Females	..	..	..	2,820
Dependents	..	..	..	42,984
Total	..	..	..	68,663

C. Public Administration and Liberal Arts.

Males	..	..	..	6,048
Females	..	..	..	969
Dependents	..	..	..	5,860
Total	..	..	..	12,877

D. *Miscellaneous.*

Males	..	..	..	7,994
Females	..	..	..	1,645
Dependents	..	..	..	7,514
Total				17,153

In Section " B " above, it is estimated that 53,548 men, women and children are dependent upon the B. B. & C. I. Railway Company.

WATER SUPPLY.

The water supply of Ajmer is from Foy Sagar, wells at Bhaonta, or Budha Pushkar Lake according to the rainfall of the year.

All these supply areas are outside the City Municipal area, and the water is piped to Service Reservoirs in the city.

From these Service Reservoirs water is piped to hydrants of which there are 84 in the city and this supply is supplemented by wells, and baories.

Very few houses in the city have a piped water supply with the result that water is mostly carried by hand from hydrants, wells and boaries.

The majority of occupants in the Railway and suburban areas have a piped water supply.

COST OF LIVING IN AJMER.

The following evidence was tendered to the Labour Commission when it visited Ajmer in November 1929, and the following budget was worked out as being the minimum

monthly requirements of a family of 2 adults and 3 children
of the lower grade of Indian Labourer :—

						Rs.	a.	p.
Food	..	..	..	..	..	21	0	0
Rent	..	..	..	..	..	3	0	0
Clothing	..	..	..	..	..	1	8	0
Bedding (renewals)	..	..	..	..	..	0	8	0
Incidental expenses, contributions, festivals, &c.	..	..	..	..	..	2	0	0
Savings	..	..	..	..	..	1	0	0
Total						20	0	0

This estimate only allows for minimum quantities of ghee, milk and green vegetables. No allowance is made for illness as it is presumed that medicines and treatment are free.

As the wages of most unskilled workers are under Rs. 20 a month, it is obvious that they are constantly in debt and in a poorly nourished condition, predisposing them to become easy victims to diseases of which, in Ajmer, Malaria is the most prevalent.



Nullah close to the Government High School. *A. stephensi* and *A. rossii* constantly breed here in enormous numbers throughout the whole year.

CHAPTER II.

HISTORY OF MALARIA IN AJMER AND THE PRESENT INCIDENCE OF THE DISEASE.

Up to the present no systematic work has been carried out with regard to Malaria in Ajmer city, nor is there any published literature on the subject. No definite anti-malarial work had been attempted until 4 years ago, when, as subsequently noted, the B. B. & C. I. Railway Co. commenced such work in the Railway Ward. For the last 5 years a small sum of money has annually been voted by the Municipal Committee for anti-malarial work, but the amount is inadequate and could not be scientifically utilised because no malaria survey has hitherto been carried out. From statistics available from hospitals and the Municipal Committee, there has been no apparent increase or decrease of Malaria during the last 10 years, but, as will be seen from the available statistics, the percentage of Malaria is a high one. The Assistant Health Officer of Ajmer City in his Annual Report for 1929-30 states that Malaria was responsible for 34.8 per cent. of the total deaths.

Annexed are graphs showing :—

The Incidence of Malaria in the B. B. & C. I. Railway Hospital and Dispensaries, and the Women's Mission Hospital in relation to average monthly rainfall, maximum and minimum temperature, and humidity, for the period under Survey, and figures of Vital Statistics.

VITAL STATISTICS.

6. *Municipal figures of Death and Birth Rates.*

Year.	Month.	Total birth.	Total death.	Deaths from Malaria.	Deaths under 1 year.	Still births.	Percentage of deaths from Malaria.	REMARKS.
1920.	January ..	169	281	66	55	..	23.45	
	February ..	180	287	98	63	1	34.15	
	March ..	198	357	113	77	..	31.65	
	April ..	183	282	67	57	1	23.76	
	May ..	165	144	39	29	..	27.08	
	June ..	143	100	17	13	..	17.00	
	July ..	122	90	18	15	..	20.00	
	August ..	146	134	43	21	1	32.00	
	September ..	142	82	10	11	..	12.19	
	October ..	155	101	41	35	1	40.59	
	November..	154	115	47	32	..	40.87	
	December ..	130	192	43	37	1	22.40	
1921.	January ..	115	217	138	90	3	63.59	
	February ..	109	135	107	88	1	79.26	
	March ..	150	157	103	97	2	65.61	
	April ..	150	150	44	39	..	29.33	
	May ..	133	133	41	37	1	30.83	
	June ..	111	111	35	27	..	31.53	
	July ..	170	155	43	31	..	27.74	
	August ..	181	165	54	48	1	32.73	
	September ..	177	190	57	43	..	30.00	
	October ..	176	301	68	55	2	22.59	
	November..	176	201	63	48	..	31.34	
	December ..	166	198	157	36	..	79.29	

Year.	Month.	Total births.	Total deaths.	Deaths from Malaria.	Deaths under 1 year.	Still-births.	Percentage of deaths from Malaria.	REMARKS.
1922	January ..	201	318	98	96	..	30.82	
	February ..	171	280	71	78	..	25.36	
	March ..	151	309	205	134	..	51.38	
	April ..	142	381	130	121	2	34.12	
	May ..	118	333	107	96	4	32.13	
	June ..	155	207	63	57	1	30.43	
	July ...	174	221	51	40	..	23.08	
	August ...	209	224	54	70	1	24.11	
	September ..	219	270	70	94	1	25.93	
	October ..	221	278	82	88	..	29.49	
	November..	223	206	74	88	1	25.00	
	December ..	254	265	74	80	..	27.93	
1923	January ..	185	273	97	97	..	35.53	
	February ..	147	292	109	75	..	37.33	
	March ..	177	413	148	107	2	35.84	
	April ..	167	463	161	121	1	34.77	
	May ...	161	407	152	131	..	37.35	
	June ..	160	305	121	80	..	39.07	
	July ..	139	214	109	75	3	50.03	
	August ..	208	231	83	84	1	35.03	
	September ..	273	329	117	122	1	36.56	
	October ..	280	307	105	99	..	34.20	
	November..	204	230	120	113	2	37.50	
	December ..	223	302	78	93	..	25.78	

Year.	Month.	Total births.	Total deaths.	Deaths from Malaria.	Deaths under 1 year.	Still-births.	Percentage of deaths from Malaria.	REMARKS.
1924	January ..	195	310	83	64	..	21.07	
	February ..	168	322	94	92	..	20.19	
	March ..	195	480	127	130	1	26.46	
	April ..	184	566	151	185	2	26.66	
	May ..	176	376	156	106	1	41.49	
	June ..	142	302	118	97	..	39.07	
	July ..	200	272	104	86	..	38.24	
	August ..	178	206	95	63	2	46.12	
	September .	177	198	54	47	1	27.22	
	October ..	173	205	66	58	..	32.19	
	November..	198	301	59	52	..	19.60	
	December .	189	202	87	61	1	43.07	
1925	January ..	194	288	144	85	..	50.00	
	February ..	198	204	110	90	..	53.92	
	March ..	132	258	115	70	..	44.57	
	April ..	181	365	139	148	2	38.09	
	May ..	173	297	106	103	1	35.69	
	June ..	167	182	83	65	1	45.65	
	July ..	192	201	95	70	2	47.26	
	August ..	173	258	90	75	..	34.88	
	September .	168	211	72	58	..	34.12	
	October ..	198	317	98	80	..	30.91	
	November..	193	212	77	71	1	36.32	
	December .	190	305	68	58	..	22.29	

Year.	Month.	Total births.	Total deaths.	Deaths from Malaria.	Deaths under 1 year.	Still-births.	Percentage of deaths from Malaria.	REMARKS.
1926	January ..	195	203	80	63	..	30.40	
	February ..	170	302	71	91	..	23.51	
	March ..	177	305	68	59	2	18.63	
	April ..	168	197	58	53	1	20.44	
	May ..	190	203	60	62	1	20.56	
	June ..	153	201	77	62	..	38.30	
	July ..	199	307	66	58	..	21.49	
	August ..	204	307	79	65	..	25.73	
	September .	197	215	77	63	3	35.81	
	October ..	180	212	97	77	1	45.75	
	November..	191	217	81	60	1	37.33	
	December .	197	203	77	60	..	37.03	
1927	January ..	195	270	130	87	..	48.14	
	February ..	190	227	98	77	1	43.17	
	March ..	197	310	83	62	1	26.77	
	April ..	177	315	72	54	2	22.86	
	May ..	202	307	68	59	..	22.15	
	June ..	169	217	63	53	..	29.03	
	July ..	187	228	77	59	3	33.77	
	August ..	199	217	66	54	1	30.41	
	September .	188	315	78	64	..	24.76	
	October ..	197	212	72	52	..	33.06	
	November..	191	217	59	49	1	27.19	
	December .	187	203	66	53	..	32.51	

Year.	Month.	Total births.	Total deaths.	Deaths from Malaria.	Deaths under 1 year.	Still-births.	Percentage of deaths from Malaria.	REMARKS.
1928	January ..	254	470	68	55	1	14.47	
	February ..	170	354	63	44	1	17.79	
	March ..	197	460	72	60	2	15.45	
	April ..	176	433	77	63	1	17.78	
	May ..	187	396	55	43	..	13.89	
	June ..	188	194	48	37	..	24.74	
	July ..	175	210	58	49	1	27.62	
	August ..	928	163	56	47	1	19.05	
	September ..	159	247	61	52	..	24.69	
	October ..	166	264	66	53	2	25.00	
	November..	167	295	77	67	1	26.14	
	December ..	189	313	71	66	1	22.68	
1929	January ..	212	344	80	77	1	23.26	
	February ..	169	338	71	66	2	21.01	
	March ..	212	421	97	78	2	23.04	
	April ..	175	466	108	97	3	23.18	
	May ..	176	486	107	85	2	22.02	
	June ..	183	376	98	63	1	26.06	
	July ..	187	290	80	71	..	27.59	
	August ..	175	286	73	55	..	25.52	
	September ..	191	257	67	47	1	26.07	
	October ..	163	325	115	93	2	38.38	
	November ..	167	398	103	77	1	25.88	
	December ..	340	502	137	53	2	27.29	

N.B.—The infantile mortality deaths under 1 year per thousand births in 1929-30 were 442, of which 154 were due to Malaria.

5. *Malaria in Ajmer Institutions :*

Institution.	Year.	Malaria cases.	Malaria deaths	All other cases.	Per cent. of Malaria cases.	REMARKS.
(a) Victoria Hospital	1920	4,018	2	25,975	13.40	
	1921	3,312	Nil.	34,111	8.85	
	1922	2,952	1	25,643	10.32	
	1923	806	Nil.	25,097	3.01	
	1924	591	Nil.	20,183	1.98	
	1925	1,030	Nil.	31,000	4.92	
	1926	3,273	2	32,040	9.04	
	1927	1,472	6	23,044	6.01	
	1928	1,440	Nil.	23,263	5.86	
	1929	1,475	3	22,859	5.98	
(b) Women's Mission Hospital ..	1920	372		4275	8.01	} Only in-door cases. No record of outdoor cases.
	1921	314		4086	7.14	
	1922	263	} No record.	4835	5.18	
	1923	236		4840	4.05	
	1924	21		558	3.63	
	1925	33		400	0.31	
	1926	472		808	34.45	
	1927	584		5,427	9.71	
	1928	680		6,843	9.11	
	1929	74		830	8.11	
(c) B. B. & C. I. Railway Hospitals and Dispensaries ..	1920	} No record.			..	
	1921				..	

Institution	Year.	Malaria cases.	Malaria deaths.	All other cases.	Per cent. of Malaria cases.	REMARKS.
(c) B. B. & C. I. Railway Hospitals and Dispensaries-- (contd.)	1922	No record.			..	
	1923	3,090	Nil.	30,223	10.00	
	1924	3,317	Nil.	29,893	9.99	
	1925	2,953	Nil.	2,8501	9.39	
	1926	4,023	Nil.	32,540	11.29	
	1927	2,000	Nil.	30,688	8.63	
	1928	3,229	Nil.	29,297	9.93	
	1929	4,310	Nil.	27,036	13.51	
(d) Police Hospital..	1920	174	No record.	198	46.78	
	1921	138		263	34.24	
	1922	119		306	28.00	
	1923	18		387	4.44	
	1924	86		456	17.53	
	1925	78		223	25.91	
	1926	163		280	36.34	
	1927	98		267	25.85	
	1928	75		1,356	5.24	
	1929	93		1,916	4.63	
(e) Central Jail ..	1920	No record.	No record.	61	2.08	
	1921					
	1922					
	1923					
	1924					
	1925	16	No record.			

Institution.	Year.	Malaria cases.	Malaria deaths.	All other cases.	Per cent. of Malaria cases.	REMARKS.
(c) Central Jail— (<i>confd.</i>)	1926	11	} No rec- ord.	60	14.08	
	1927	22		44	33.33	
	1928	32		40	44.44	
	1929	30		56	34.88	

CHAPTER III.

Spleen Index.

During the period of this survey the approximate number of children attending the Primary Schools in Ajmer was 1,600. 75 per cent. of these (*i.e.*, 1,200) were examined with the following result :—

Ward.	Name of School.	Number of children examined.	Number of enlarged spleens.	Per cent. with enlarged spleens.	Per cent. of those with enlarged spleens who showed parasites in their peripheral blood	Variety of parasites found.
1	Municipal Vernacular School ..	126	40	31.75	..	..
1	A. V. Middle School ..	57	3	5.26	..	..
1	Government Model School ..	30	3	10.00	..	..
3	Agarwal Pathashala ..	60	3	8.33	..	..
4	Gujarati School ..	17	1	5.88	..	..
5	Sayada Primary School.	52	5	9.62	..	..
5	Arya Nagri Pathashala .	26	5	19.23	..	..
7	Oswal Jain High School.	54	17	31.48	..	..
7	Lungia Orphanage School	28	8	28.57	12.50	M.T.
8	Oswania Khawaja School	32	2	6.25	..	..
8	Darga Sharif School ..	193	20	10.36	5.00	M.T.
9	D.A.A.V. High School ..	166	50	30.12	4.00	M.T.
9	Islamia High School ..	117	35	29.96	..	..
9	S. A. V. School, Idgah ..	48	5	10.42	20.00	B.T.
11	Husband Memorial School ..	54	10	18.52	..	..
11	B. B. & C. I. Railway Adler School ..	63	4	6.35	..	..
11	Government High School	44	3	6.82	33.33	M.T.
11	Dakshani School ..	33	2	6.06	..	..
	Total ..	1,200	218	15.28	4.21	%M.T. 83.3 %B.T. 16.7.

In addition to the above 557 random samplings were taken from all parts of the city and suburban areas with the following result :—

Ward.	Area.	Number of children examined.	Number of enlarged spleens.	Per cent. with enlarged spleens.	Per cent. of those with enlarged spleens who showed parasites in their peripheral blood.	Variety of parasite found.
5 & 6	Diggi Bazaar	96	12	12.50	16.67	M.T.
7	Lungia (Lakhankotri) ..	83	20	24.10	25.00	M.T.B.T
10	52 Bungalows area ..	217	29	12.90	10.34	M.T.
10	5 & 8 Bungalows area ..	75	3	12.00	33.33	M.T.
11	Civil Lines	71	10	11.08	60.00	M.T.B.T.
11	Mayo College	55	3	5.45	..	..
	Total	557	77	13.55%	24.22%	% M.T. 76.5 % B.T. 23.5

Grand Total :—1,757 examined.

295 enlarged spleens.

14.42% Splenic Index.

11.22% Parasite rate of those with enlarged spleens.

N.B.—M.T. = Malignant Tertian.
B.T. = Benign Tertian.

Children between the ages of 2-10 years only were examined. Spleen measurements were corrected by correction table supplied by the Kasauli Malaria Bureau and the average spleen was found to be one with the apex 8.9 cm. from the umbilicus.

All spleen measurements were made by one and the same worker (S. A. W.).

Christopher's method for measuring the position of the enlarged spleen was used.

Thick drop blood smears were taken from all children showing splenic enlargement. They were stained with Leishman stain in the usual way. In view of the fact that the survey was carried out by voluntary workers who were all busy people giving up their recreation time to the work, it was felt that to use Sinton's method of enumerating parasites against a standard fowl suspension would be a refinement which was not really necessary.

No case of Kala Azar was reported by any of the Hospitals, Dispensaries or Private Practitioners in Ajmer City during the period of this survey.

We cannot conclude this chapter without expressing our special appreciation of the help given to us by Rai Sahib P. B. Joshi, M.A., B.Sc., Assistant Director of Education, Ajmer-Merwara, in connection with the Spleen Census. He made arrangements for all our visits to schools and himself accompanied us on all occasions. Without his enthusiastic help we could never have completed the work in such a short time. We believe that as a result of the distressingly high percentage of physical disabilities amongst the school children noticed during our visits he has gained still stronger proof of the urgent necessity for the inauguration of a School Medical Service in Ajmer-Merwara, a project which has been very near to his heart for years.

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CHAPTER IV.

THE ANOPHELINE MOSQUITOES OF AJMER AND THEIR BREEDING PLACES.

The following species of anopheline mosquitoes were found in Ajmer City. They were mostly bred out from larvæ found all over the city and suburban area :—

Species.	Per centage of each species.
<i>A. subpictus</i> Grassi ("rossii" Giles).	1,570 66.79
<i>A. stephensi</i>	782 33.08
<i>A. culicifacies</i>	3 0.13

The above mosquitoes were identified by the Junior Author and despatched to either the Liverpool School of Tropical Medicine or to the Central Malaria Bureau, Kasauli, who kindly verified the identification.

It will be noted that *A. subpictus* Grassi ("rossii" Giles) predominates in all parts of Ajmer. The larvæ of this mosquito were found in all collections of water with the exception of cess pools. As it has never been found infected with Malaria in India, although many thousands of specimens have been dissected, it can be ignored as a carrier of Malaria in Ajmer. It can be included, however, with the *Culex* and *Aedes* as a public nuisance. Owing to the lack of drainage in the city, there is a tremendous amount of filthy water lying about, and in sumps abutting on the streets, and these collections of water were found to be breeding places of both *Culex* and *Aedes*. Constant complaints were made by the inhabitants about disturbance to sleep due to biting of these mosquitoes. It is difficult to assess the loss of efficiency amongst workers due to this lack of sleep, but it is a point which is by no means negligible, and is worth consideration by employers of labour in the city. Much could be done to eradicate these pests if an efficient drainage system was employed.

40 feet. It is well stocked with fish which are immune by Regulation from capture and which eat any larvæ which may hatch out in it. Repeated examinations during the Survey were negative as regards larvæ.

The Ana Sagar and the Beechla are artificial tanks which quickly dry up during a bad monsoon year. As they become shallow, the margins and isolated side pools of both form ideal breeding places for mosquitoes and *A. rossii* and *A. stephensi* larvæ were found there in enormous numbers during July, August, September and October.

Hydrants.—There are approximately 84 hydrants in the city. Until recent years, the waste water from these hydrants was collected in masonry sumps and then carted away. For the last few years an attempt has been made to convert the sumps into soak pits to avoid the expense of sullage removal. This work, however, has in most cases been so badly done that the sumps do not act as soak pits, but the water stagnates and larvæ of *A. stephensi* were found in 90 per cent. of them, and in all sumps.

A (3) *Nullahs*.—There are many improperly graded kutchha nullahs and storm water drains in Ajmer. All of these throughout the city are potential breeding places.

A (4) Cattle troughs.

Cisterns.

Khus khus tatti tanks.

Water barrels.

Drinking matkas (earthen pots).

Garden howds (sumps).

Well sumps.

Ward Inspection.—All wards were carefully inspected, mohalla' by mohalla, and the following breeding places are particularly worthy of special consideration :—

Ward No. 1.—Naya Bazaar Piao in front of the Magazine.
A large nadi on the West of the Magazine wall.

Ward No. 2.—(*Ghas Katla*).—Dyers' pots and water tubs.
(See photograph). Mutkas.

Ward No. 3.—(*Moti Katla*).—Sumps in private bungalows.

Ward No. 4.—Water trough near Neemthar.

Ward No. 5.—Garden sumps of St. John's Church.

Ward No. 6.—Overflow drain from Diggi Tank.
Kutchra pools of water near Khari Baori.

Ward No. 7.—Potters' tubs of water.
Oilmen's pots of water.

Ward No. 8.—Drinking water pots kept at different places
at Dargah for pilgrims.
Sump outside Dhai-din-ka-Jhaunpara.

Ward No. 9.—Cattle trough outside Osri Durwaza.
Sumps in Private gardens.
Sita Ram Gowshala.
Tejaji's tanki.
Pucca drain at Suraj Kund.
St. Anselm's School and Church garden sumps.
Sumps at Edward Memorial.
Sumps at Vedic Yantralaya.
Sumps near Kaisarganj dial.
Sumps in Government College Compound.
Baori at Idgah. (See photograph.)

Ward No. 10.—(*Rly. Ward*).—All private garden sumps.
Khus khus tatti tanks.
St. Mary's Church garden sumps.
Storm water nullahs of which there are 9
important ones.

The sanitation in this ward is carried out by the Local Committee of the Railway with the Railway Executive Engineer as President, the Railway Medical Officer as

Honorary Secretary, and representatives of all the important departments are on the Committee. Four years ago definite anti-malarial work was started by this Committee and now two anti-malarial gangs are at work. They visit all compounds and treat potential breeding places at least once a week. Unfortunately the value of much of this good work is discounted by the fact that untreated breeding places abound on Municipal land on the borders of the Railway Ward. It is hoped that as a result of this survey some co-operation may ensue which will put an end to this ridiculous and uneconomic state of affairs.

Ward No. 11.—All garden sumps in Civil Lines and private bungalows.

Baori near Ajmer Club. (See photograph).

Kutchra pools of water in fields near Kala Bagh.

Garden sumps in Mayo College, and kutchra sumps in the fields near South Octroi Post.

There is a nullah leading from the Kaisar Bagh passing under the Jaipur Road culverts and passing the Ajmer Electricity Supply Company's buildings, thence under the Kutchery Road and then on past the Government High School, to Beechla. Throughout the whole year this is a constant breeding place of *A. stephensi* and *A. rossii* in enormous numbers. (See photograph.)

Owing, however, to the public spirited efforts of the late Managing Director of the Ajmer Electricity Supply Company, mosquitoes were not allowed to develop in the part of the nullah passing his land. He had the affected part sprayed regularly with oil and the nullah swept down once a week. Near the Government High School this nullah receives the overflow water from a Dhobi Ghat with the result that the part of it running between the Government High School and the Beechla hardly ever dries up and during 5 out of the 6 months of this survey larvæ of *A. stephensi* and *A. rossii* were always found in enormous quantities in it. (See photograph.) This is a constant menace to the health of the scholars of the Government High School.

CHAPTER V.

ANTI-MALARIAL MEASURES RECOMMENDED.

I. Wells.

(a) *Used wells*.—They should be fitted with a concrete cover and with pumps. If for any reason this cannot be done, the wells should be stocked with fish. The following varieties have been found useful :—

1. Haplachilus.
2. Barilius.
3. Chela.
4. Barlius.
5. Khajura.

The overflow from used wells should be made to drain into soak-pits or absorbent plants. Experience has proved that the Oleander plant is the most suitable in Ajmer for absorption purposes, *e.g.*, the whole drainage of a large institution like the Railway Hospital is by means of such plants. This method is cheap, pleasant and efficient.

(b) *Disused wells*.—All disused wells should be filled in or hermetically sealed with a concrete cover. For filling in rubbish might be used upto 4 feet of the top and then earth.

II. Baories.

(a) *Used baories*.—They should be stocked with larvicidal fish.

(b) *Disused baories*.—However picturesque, they are potential breeding places and should be filled up in the same way as disused wells.

III. Tanks.

(a) *Ana Sagar*.—The edges of the tank should be kept free from depressions and sluggish pools as far as possible. As fishing is prohibited in this tank, the introduction of larvicidal fish would be most useful for the main body of water.

but the edges of the tank and pools on the fringes of the tank should be sprayed with oil or Paris Green during the breeding season.

(b) *Beechla*.—The soil from this tank is in much request during the dry season for agricultural purposes, with a result that borrow pits are formed. After rain these borrow pits form ideal breeding places for mosquitoes. The owners of this land should be served with a notice under Regulation 159 of Municipal Regulations of 1925 to fill up or drain these borrow pits. Action of this sort is likely to be slow in Ajmer-Merwara so we recommend, as a temporary measure, that Kerosene oil or Paris Green be regularly applied to this area once a week to prevent breeding of mosquitoes.

IV. *Hydrants.*

The waste water of hydrants should be dealt with by properly constructed soak-pits systematically inspected to ensure proper working.

V. *Nullahs and Storm Water Drains.*

These nullahs and drains are chiefly provided for rain water and as a rule do not remain wet during the dry season, and although they are recognised as permanent drains, they are, at present, merely meandering nullahs. During the monsoon they should be sprayed with Paris Green once a week. There are certain nullahs, *viz.*, Ganda Nullah and the nullah passing the Ajmer Electrical Supply Co.'s Power House which remain wet throughout the year as they are used as waste water drains. They should be converted into properly constructed masonry drains in which breeding can be controlled by sweeping and spraying.

VI. *Cattle Troughs, &c.*

The troughs already existing should be systematically emptied out and dried once a week. New ones should be properly graded to drain from an exit plug.

VII. *Garden Howds or Sumps.*

The following type of anti-malarial garden howd has been recently devised by the Senior Author and it can be completely emptied merely by removal of a plug and the water thus removed is led into absorbent plants. Its introduction in place of present underground sumps would remove many hundreds of potential breeding places of mosquitoes in Ajmer. Even the most illiterate coolie could be taught to empty a howd of this sort once a week with the minimum of labour.

If the expense of altering the present howds be too much we advise that some species of *Carassius Auratus* (Gold Fish) be kept in them. They are voracious feeders on malaria larvæ. (Plan of anti-malarial howd annexed.)

VIII. *Roofs.*

Proper grading of roofs should be enforced on all landlords.

IX. *Khus-khus tatti Tanks.*

An estimate may possibly be sanctioned to render all khus-khus tatti tanks mosquito-proof.

X. *Quinine and Cinchona.*

Prevention is better than cure. If the permanent anti-malarial measures recommended by us are carried out there will be little or no malaria in Ajmer.

The free distribution of Quinine and Cinchona, which is carried out in some cities in India, seems to be unnecessary in Ajmer City where there are enough hospitals and free dispensaries capable of dealing with any cases of Malaria.

XI. *Municipal Regulation.*

Regulation No. 159 of the Municipal Regulation for Ajmer-Merwara of 1925 states that—

“ A Committee may, by notice, require the owner or occupier of any land or building in the Municipality to cleanse, repair, cover, fill up or drain off any

private well, tank, reservoir, pool, depression or excavation therein which may appear to the Committee to be injurious to health or offensive to the neighbourhood".

" Provided that, if for the purpose of effecting any drainage under this section it is necessary to acquire any land not belonging to the same owner or to pay compensation to any person, the Committee shall provide such land or pay such compensation."

Rigorous application of the above regulation would considerably reduce the incidence of Malaria in Ajmer City.

Conclusions.

The most ubiquitous menace to life and health in the Tropics is Malaria. There are many other tropical diseases which have a more rapid climax and more visible physical results than Malaria but there is no other disease which so saps the energy and undermines the economic powers of the people. Ross estimates the total amount of sickness due to it roughly at between a quarter and a half the total sickness in many tropical countries. In India it has been officially estimated to kill 1,130,000 persons per year.

The observations of the Senior Author during nearly sixteen years' medical practice in Ajmer had led him to suspect that the incidence of Malaria in Ajmer was far higher than was generally supposed and than would be expected in a place with such a comparatively small annual rainfall. These suspicions have been confirmed by the results obtained in this survey.

The Spleen Index proves that Ajmer is an area of Moderate Endemicity as regards Malaria, but as may be seen by the graph facing page 16, it is liable to become an area of High Endemicity whenever there is excessive rainfall.

It cannot be too strongly stressed that Malaria is a preventable disease and that in Ajmer there need be little or none.

Malaria in Ajmer is almost entirely man-made and might easily be eradicated in a short time.

As regards the future, the chief hope lies in education, and in this connection we note with pleasure that in the 1930-31 Hygiene Syllabus for the Reynolds Shield Competition for Girls' Schools in Ajmer-Merwara, simple anti-malarial teaching has been included.

Also as a result of this survey Rai Sahib P. B. Joshi, M.A., B.Sc., Assistant Director of Education for Ajmer-Merwara, has suggested that Hygiene teaching for at least 2 hours per week be included in the curriculum for all girls' and boys' schools in Ajmer-Merwara and that simple anti-malarial teaching should be part of this Hygiene Syllabus.

As regards the present it has been our privilege to prove the presence of this evil in our economic system and show how it can be scientifically attacked. We have purposely avoided the question of finance because this is one which has to be dealt with by all the many varying interests in the city, but there is no doubt that if even the small amount at present spent on anti-malarial work by the different public and private bodies in the city was scientifically utilised, the incidence of malaria would rapidly decrease. What is required is for a few men and women of good-will from the communities concerned to get together and insist that a properly organized attempt be made to eradicate the disease.

APPENDIX.

The Liverpool School of Tropical Medicine and the Central Malaria Bureau, Kasauli, intimated their wish to have mosquitoes of any variety. During the course of this Survey, therefore, the following mosquitoes were also identified and sent to one or other of these Institutions :—

<i>Culex fatigans</i>	♂	..	454
" "	♀	..	424
" vishnui	♂	..	1
" "	♀	..	1
<i>Lutzia</i>	♀	..	1
<i>Stegomyia fasciata</i>	♂		20
" "	♀		21
" vittata	♂		38
" "	♀		23
<hr/>			
Total	..		983

A small charge of rupees two (Rs. 2) is made to cover the printing and other incidental expenses of this report. If any excess over expenditure is received it will be devoted to the Railway Hospital Samaritan Fund.

